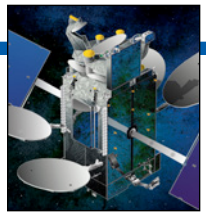
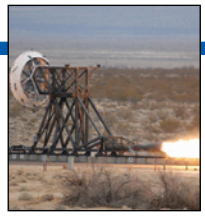
National Aeronautics and Space Administration

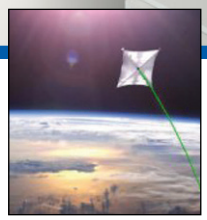
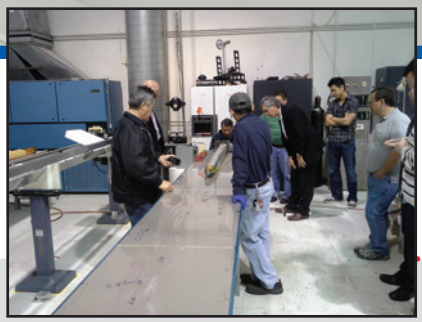
Technology Demonstration Mission Program

The Bridge

Volume 1, Issue 2
March–April 2013





‘Sunjammer’ Project Sails Through Latest Boom Tests

The Solar Sail Demonstration project, a Technology Demonstration Mission led for NASA by industry manufacturer L’Garde Inc. of Tustin, Calif., is in the process of completing a series of deployment tests of the 89-foot prototype boom that will serve as the structural support for the solar sail once it is deployed.

A solar sail uses the minute pressure of photons emitted from the sun to propel a spacecraft – providing “sail power” for a journey through space. NASA is working with L’Garde, the National Oceanic and Atmospheric Administration and other commercial partners to prove the viability and value of this propellant-free transport system.

The solar sail — dubbed “Sunjammer” by its designers in honor of the 1964 Arthur C. Clarke story of the same name, in which Clarke coined the term “solar sailing” — will deploy and operate a sail approximately 124 feet on a side. That’s almost 13,000 square feet, or a third of an acre — seven times larger than any solar sail ever tested in space.

When stowed in its launch configuration, Sunjammer is the size of a dishwasher and weighs just 70 pounds. Attached to a 175-pound disposable support module, it will be easily packed into a secondary payload on a rocket bound for low-Earth orbit.

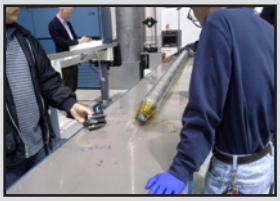
The team recently conducted a successful series of boom deployment tests, assessing the smooth performance of the system that will provide structural support to the solar sail. For transport to space, the sail is stowed in a folded state no more than a foot in length. The tests are intended to maximize stowage and deployment repeatability, thereby minimizing overall system risk.

To unfurl the boom during testing, the cylinder is pressurized and observed for potential leaks. During the first test, the team was able to troubleshoot and correct pressure leaks related to the stowage technique. The team implemented the new stowage techniques and observed no leaks during the second deployment tests.

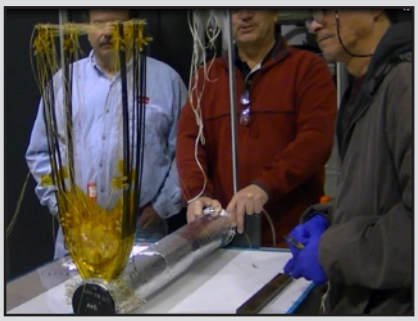
These series of tests also permitted the team to demonstrate the innovative boom spreader system — a crucial piece of solar sail technology used to increase the strength of the booms, making them extensible to support much larger solar sail missions. Without the spreader system, the solar pressure on an extremely large sail would cause the boom system’s structural members to bend, which would degrade performance.

The Sunjammer demonstration mission is set to launch on a SpaceX Falcon 9 rocket as early as 2014.

Members of the L’Garde team begin the first boom deployment test, watching the pressurized boom slowly extend. (Photo: L’Garde)



Team members record the deployment and monitor for pressure leaks. Tests typically take 15 minutes for full deployment; the actual in-space procedure can take 30-45 minutes. (Photo: L’Garde)

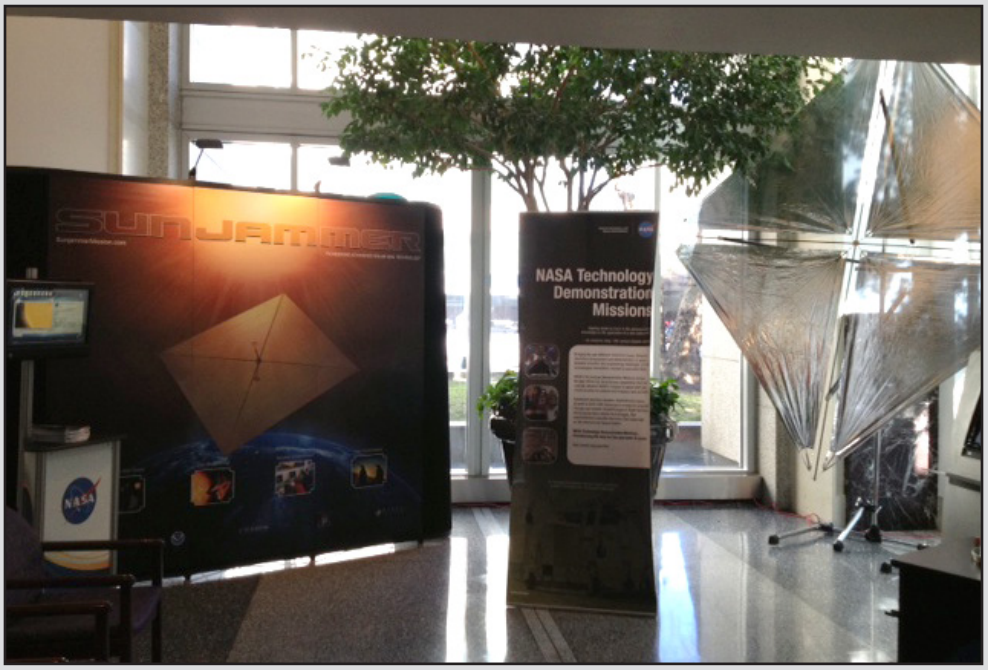


The innovative boom spreader system undergoes its first deployment test. (Photo: L’Garde)

L’Garde technician Long Nyugen, right, adjusts the boom spreader during deployment as Yuki Michii, L’Garde programs manager and senior analyst, looks on. (Photo: L’Garde)

Hail to the Chief

The Sunjammer solar sail was among the Technology Demonstration Missions highlighted in NASA exhibits in Washington during the Presidential Inauguration. During an open house Jan. 18-20 at NASA Headquarters, more than 1,000 visitors enjoyed learning about NASA's plans for future human space exploration; the value and impact of new space technologies; science on the International Space Station; and new plans for Mars exploration. NASA also took part in the National Day of Service on the National Mall Jan. 19. In addition, NASA participated in the inaugural parade Jan. 21, with employees walking alongside full-scale models of the Curiosity Mars rover and the Orion spacecraft, set for flight testing in 2014. (Photo: Keyke Reed)



Green Propellant Project Passes Major Milestone, Readies for Design Review

After NASA selected Ball Aerospace & Technologies Corp. of Boulder, Colo., in August 2012 as the prime contractor to develop the Green Propellant Infusion Mission, Ball and their partners quickly began executing the project in order to prepare for launch, scheduled for 2015.

Joining Ball are a team of co-investigators from Aerojet Corporation of Redmond, Wash.; U.S. Air Force Research Laboratory at Edwards Air Force Base, Calif.; Air Force Space and Missile Systems Center at Kirkland Air Force Base, N.M.; NASA's Glenn Research Center in Cleveland; and NASA's Kennedy Space Center, Fla.

In January, Ball hosted the program's successful Systems Requirements Review, defining the demonstration requirements to ensure the project is properly positioned to begin the design process. The team is now ordering parts for the spacecraft and developing thrusters. The next major milestone is the Preliminary Design Review, set for this coming July.

The team will develop and fly five thrusters specifically designed to use a high-performing green propellant aboard a Ball Configurable Platform — the BCP-100 spacecraft — to validate the performance characteristics of the green fuel and thrusters in space. Though some characteristics may be ascertained by ground tests, in-space testing is the only way to provide true system-level validation of this exciting new technology.

The fuel and its accompanying technology offer many advantages for future satellites, including fewer operational hazards on the ground, decreased complexity and cost of launch processing extending mission durations, additional maneuverability, and increased payload space .

Learn more about the project here.

http://www.nasa.gov/mission_pages/tdm/main

Tailoring Sets Standards for Project Efficiency

From the TDM Project Manager

By John McDougal

McDougal manages the TDM Program Office at the Marshall Center.

Our goal within the Technology Demonstration Mission is to improve execution of low-cost, risk-tolerant flight projects to demonstrate new space technologies. By tailoring and standardizing our project processes, innovations in technology applications and project development can be exploited to the fullest possible extent.

TDM projects provide a low-cost, risk-tolerant opportunity to demonstrate high-value technologies that can enhance or enable future science and exploration missions. They also provide an environment to experiment with novel approaches to develop missions in a cost-effective, less time-consuming way.

To make the most effective use of our TDM projects, we needed to determine a minimum compliance for all related requirements. This "tailoring" was started when TDM was in formulation, and it continues today. We have worked with NASA's Office of the Chief Engineer and other requirement offices to develop a tailoring standard for TDM projects.

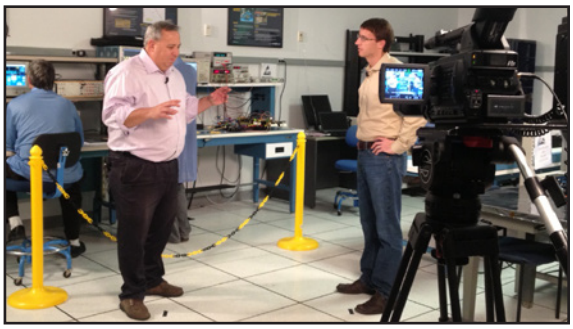
Why is this important? Because the future development of TDM projects greatly depends on the way we manage them. If our processes are efficient, standard and streamlined, then our projects should be executed in the same fashion.

NASA Edge Talks TDM Around the Nation

Episode to debut in March

McDougal at table with Blair Allen (Photo: NASA/MSFC)

In recent months, reporters and video crews for "NASA EDGE" — the agency's engaging, informative news magazine series — have traveled around the country to profile Technology Demonstration Mission team members and find out more about our exciting technologies. Cohost Blair Allen, right, chats with John McDougal, manager of the Technology Demonstration Mission Program Office at NASA's Marshall Space Flight Center in Huntsville, Ala., for an overview of the program and its nine promising projects. Watch www.nasa.gov/nasaedge in March for the TDM-focused episode.



Chris Giersch chats with Mike Weiss at Goddard (Photo: NASA/GSFC)

At NASA's Goddard Space Flight Center in Greenbelt, Md., Mike Weiss, left, project manager for the Laser Communications Relay Demonstration, outlines for "NASA EDGE" cohost Chris Giersch how the project will revolutionize the way we send and receive video and other data from space, using lasers to encode and transmit data at rates 10 to 100 times faster than radio. Such a leap in technology could deliver video and high-resolution measurements from spacecraft over planets across the solar system — permitting researchers to make detailed studies of conditions on other worlds the way we now track hurricanes and other climate and environmental changes here on Earth.

(Photo: NASA/ARC)

"NASA EDGE" cohost Chris Giersch explores "remote" possibilities as the series delves into the Human Exploration Telerobotics projects led for TDM by NASA's Ames Research Center in Moffett Field, Calif. The HET team showed "NASA EDGE" a variety of ways in which telerobotics — remote control of robotic arms, rovers and other devices, including SmartSPHERES like this one now being tested and used on the International Space Station — can take routine, dangerous or long-duration tasks out of human hands and improve space exploration.

Bridge Builders: Mike Meacham

Editor's Note: Each issue, we'll interview a key player in TDM — team members at various NASA centers and partner organizations who are helping bridge the gap to bring one of our cutting-edge technologies to flight readiness. Got a suggestion for a team member worthy of a place in the limelight? Email richard.l.smith@nasa.gov.

NASA engineer Mike Meacham.
(Image courtesy of Mike Meacham)

Mike Meacham is a NASA engineer supporting the Low Density Supersonic Decelerator project at NASA's Jet Propulsion Laboratory in Pasadena, Calif. A native of Boston, Meacham holds undergraduate and graduate degrees in engineering from Cornell University in Ithaca, N.Y.

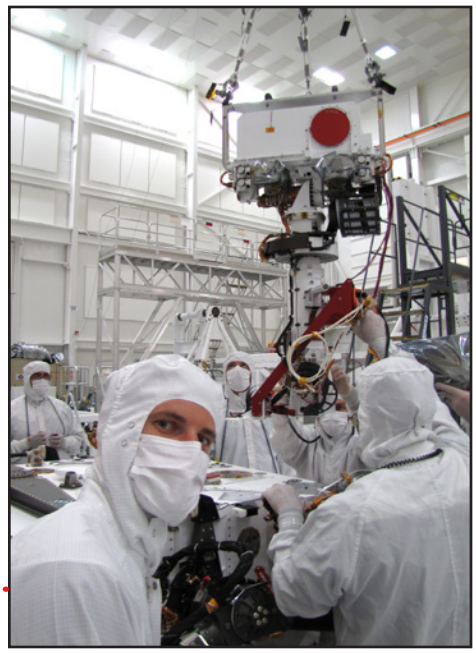
What aspect of your TDM project are you working on?
My project is testing a new Mars parachute and two different inflatable decelerators, each of which would be attached to the perimeter of the heatshield on an entry body to create drag. I have conceived and designed rocket sled tests that load up these devices to the correct dynamic pressure so we can structurally qualify their strength. These rocket sled tests are a bit like an outdoor wind tunnel. The first successful test took a full-scale entry body shape to approximately 300 mph, allowing us to test the Supersonic Inflatable Aerodynamic Decelerator, or SIAD.

What's next?
I am building up the next test now, set for this summer. We'll deploy a parachute from a helicopter 1,200 meters up, or about 3,937 feet. A long rope hangs from the base of the parachute and while the chute inflates, it will be pulled toward a rocket sled, where the base of the rope latches to the sled's back. Upon latch-up, the sled's rockets will ignite and the rope will be pulled around a large pulley. The rocket sled will load up the parachute with 125,000 pounds of force at a speed of roughly 100 mph.

How do you hope your contributions and your work will impact NASA's TDM goals?
I hope these tests open up an entirely new way of testing large drag bodies. Current wind tunnels do not have the capabilities required to test these devices — but, with a little innovation, you may be able to achieve your test requirements with a rocket sled track.

How did you get your start at NASA?
I joined JPL in August 2005. I first provided mechanical engineering support for the fiber optics team on the Mars Science Laboratory, but quickly transitioned to the remote sensing mast team, where I designed flight hardware for the mast for almost five years.

What's one thing most people would be surprised to learn about you?
I live in a geodesic dome house in the mountains!



Meacham, left front, and colleagues at work in a Jet Propulsion Laboratory clean room. (Image courtesy of Mike Meacham)

National Aeronautics and Space Administration

George C. Marshall Space Flight Center
Huntsville, AL 35812
www.nasa.gov/marshall

www.nasa.gov

NP-2013-03-015-MSFC
8–563057